

### **Remarks/Arguments**

#### **A. Pending Claims**

Claims 17-32 are pending. Claims 17-30 have been amended for clarification and/or for correction of typographical errors. Claims 1-16 have been cancelled.

#### **B. The Claims Are Not Anticipated By Menon Pursuant To 35 U.S.C. § 102(b)**

The Examiner rejected claims 1-2, 4-7, 9-18, and 20-32 under 35 U.S.C. 102(b) as anticipated by U.S. Patent No. 5,346,872 to Menon et al. (hereinafter "Menon"). Applicant respectfully disagrees with these rejections.

The standard for "anticipation" is one of fairly strict identity. To anticipate a claim of a patent, a single prior source must contain all the claimed essential elements. *Hybritech, Inc. v. Monoclonal Antibodies, Inc.*, 802 F.2d 1367, 231 U.S.P.Q.81, 91 (Fed. Cir. 1986); *In re Donahue*, 766 F.2d 531,226 U.S.P.Q. 619,621 (Fed. Cir. 1985).

The Examiner states:

Menon, et al. teach an ethylene catalyst (col. 9, l. 34-36) having a magnesium dihydroxycarbyoxide (prepared from reacting Mg with an alcohol) (col. 3, l. 53-59; col. 5, l. 9 – col. 6, l. 10) followed by a titanium compound (col. 3, l. 59-64; col. 8, l. 1-50) and/or vanadium compound (col. 3, l. 59-64; col. 7, l. 42-68) and/or silica compound. (col. 2, l. 34 – col. 9, l. 40) Halogenated titanium (col. 3, l. 65 – col. 4, l. 2), vanadium compound (col. 4, l. 3-8) are reacted with a halosilane (col. 4, l. 9-28; col. 6, l. 49-68; col. 8, l. 67 – col. 9, l. 10) and optionally with an aluminum compound, particularly a haloaluminum compound (col. 4, l. 13-15; col. 6, l. 49-68) or alkylaluminum compound (col. 8, l. 57-66).

Menon appears to teach a polymerization catalyst produced on a porous, inorganic support. For example, Menon states:

The preferred solid catalyst component utilized in the present catalyst system is prepared by initially contacting a porous, inorganic oxide support, such as silica, with at least one hydrocarbon soluble magnesium compound or a magnesium aluminum complex and at least one modifying compound.

A preferred support is silica that has a high surface area and high pore volume.

(Menon, column 4, lines 34-41)

In a preferred embodiment, the surface-modified silica is then contacted with at least one hydrocarbon soluble magnesium-containing compound or a magnesium aluminum complex.

(Menon, column 5, lines 9-12)

Menon appears to describe a process in which, in the process of ethylene and  $\alpha$ -olefin polymerization, Menon appears to teach the use of a halosilane cocatalyst component along with an aluminum compound, which is the usual cocatalyst used along with a titanium-vanadium solid catalyst. Menon appears to teach that the titanium-vanadium main catalyst is prepared by a process that includes:

- a) contacting silica removed of its surface hydroxyl groups as an inorganic support with a magnesium compound or a magnesium aluminum compound;
- b) treating the product with alcohol in the case of using the magnesium aluminum complex in the above step (a);
- c) selectively contacting the product of steps (a) or (b) with silicon halide, boron halide, aluminum halide, or their mixtures; and
- d) obtaining a titanium-vanadium solid catalyst by reacting the product of the step (c) with a titanium compound and a vanadium compound.

The catalyst system described in Menon appears to include the main catalyst prepared by the above process and two cocatalysts (halosilane and an aluminum compound).

Claim 17 recites in part:

preparing a magnesium solution by contact-reacting a halogenated magnesium compound with alcohol;

reacting the magnesium solution with an ester compound comprising at least one hydroxy group, or a phosphorus compound and a silicon compound comprising alkoxy groups, and then producing a solid component by adding a mixture of a titanium compound and a silicon compound thereto; and

reacting the solid component with an aluminum compound, and then reacting the same with a titanium compound, or a titanium compound and a vanadium compound.

Menon does not appear to teach or suggest the features of claim 17 including, but not limited to: "reacting the magnesium solution with an ester compound comprising at least one hydroxy group, or a phosphorus compound and a silicon compound comprising alkoxy groups". Menon does not appear to teach or suggest the features of claim 17 including, but not limited to: "then producing a solid component by adding a mixture of a titanium compound and a silicon compound thereto".

Menon states:

The solid product containing the soluble hydrocarbon magnesium containing compound or magnesium aluminum complex is then reacted simultaneously or in successive steps of no particular order with a titanium containing compound and a vanadium containing compound.

(Menon, column 7, lines 35-40)

Menon does not appear to teach or suggest the features of claim 17 including, but not limited to: "reacting the solid component with an aluminum compound", wherein the solid component is produced by adding a mixture of a titanium compound and a silicon compound to a magnesium solution reacted with an ester compound or a phosphorus compound and a silicon compound comprising alkoxy groups.

Additionally, Applicant's claimed catalyst includes magnesium as the main component of the inorganic support. In contrast, Menon appears to describe a catalyst in which silica is the main component of the inorganic support. Contrary to the claimed invention, in which, as shown

in step (a) of the production process for the catalyst, magnesium is used as the main inorganic support component, Menon appears to teach the use of silica as the main component of the inorganic support. Accordingly, in terms of the main component of the inorganic support, there is a difference between the two processes.

Magnesium and silica are distinguished from each other in nature as metal and non-metal respectively, are considerably different in their electronic properties. Therefore, the support including magnesium only and the support including silica and magnesium differ in the selectivity of specific electron donors. In other words, the proper type of electron donor and the kind and number of functional groups on the electron donor should vary depending on the main components of the support included in the catalyst composition.

As stated above, the main catalyst component of the support becomes a component of the solid catalyst composition. While the support included in the catalyst composition of Menon, et al. includes silica removed of a surface hydroxy group, the support of the claimed catalyst does not include silica.

Additionally, Applicant's claims are directed to the reaction of a magnesium solution, obtained by reacting a magnesium compound and alcohol, with an ester compound having at least one hydroxyl group or a phosphorous compound and a silicon compound having alkoxy groups. In contrast, Menon process for the production of its catalyst does not appear to teach or suggest this reaction.

If an organic compound is to be used as an electron donor, it should include an element that can give electrons, i.e., an element having one or more electron lone pairs, in the molecule. These elements can be oxygen, nitrogen, sulfur, phosphorous or halogen. These elements have different attractive forces of atomic nuclei on their electron lone pair, and therefore these elements have different electron donating abilities. Applicant submits that the element actually donating the electrons, in the electron donor compound, determines, to some extent, the electron donating ability of the compound. Also, these elements are included in the specific functional

group of the molecule and are typically bonded with other elements. Since the type of functional group and/or bond can affect the attractive force of an atomic nucleus on the electron lone pair, i.e. the electron donating ability, the type of functional groups and the element donating electrons in the electron donor compound determine the electron-donating ability of the compound.

In determining whether the electron donor compound is used in the preparation of a catalyst compound is related to prior art, the element used in the electron donor compound and the functional group that includes said element should be considered, rather than just general types of electron donor compounds.

In the electron donor used in Applicant's claims, oxygen donates electrons in the ester compound including at least one hydroxy group. The oxygen of the hydroxyl group is the primary electron donor and is bonded to carbon and hydrogen. For the phosphorous compound, phosphorous is the electron donating element. The oxygen atoms bonded to phosphorous in, for example, the phosphoric acid group are the primary electron donor. For the silicon compound, oxygen is the primary electron donor. The oxygen in the silicon compound is part of an alkoxy group and is bonded to carbon.

On the other hand, the electron donor of Manon, halogen of the silicon halide is the primary electron-donating element. For the boron halides described, halogen is also the primary electron-donating element. Additionally, for aluminum halide, halogen is the primary electron-donating element.

As stated above, the element that donates the electrons, the functional group which the element is part of, and the bond between this element and other elements are different from the electron donors described in Manon.

In the claimed process titanium and silicon compound are reacted in step (c), followed by reaction of a titanium compound and a vanadium compound in step e). Applicant submits that

Manon does not appear to teach or suggest this reaction process, in combination with the other features of the claims.

The claimed reaction process is in a single homogeneous liquid phase at the time of introducing an electron donor. In Menon, however, the reaction system is a heterogeneous mixed phase of solid and liquid at the time of introducing the electron donor, since the electron donor is introduced after solid precipitation is formed.

If an electron donor is introduced after the solid precipitation is formed, as cited in Menon, there may be more limitations in the positions on which the electron donor can be supported, and in the possible 3-dimensional orientations of the electron donor, in contrast to Applicant's process in which a solid is precipitated from a homogeneous solution of the magnesium support and the electron donor. Due to these limitations, the possible 3-dimensional structures of the solid precipitation are limited in Menon, thus the 3-dimensional structure of the catalyst produced by Menon may differ from Applicant's claimed catalyst.

In the Office Action, the examiner has taken the position that Menon has described reacting of a titanium compound and a vanadium compound with a halosilane and an aluminum compound. Menon states:

The above-obtained solid catalyst component (i.e., the main catalyst) is then reacted with an aluminum-containing first cocatalyst and in a preferred embodiment with an aluminum-containing cocatalyst and a halosilane second cocatlayst during polymerization.

Applicant submits that the above described halosilane and aluminum compound are not reacted with a titanium compound and a vanadium compound during the process for production of the main catalyst. Instead, Menon appears to teach that the titanium compound and the vanadium compound contained in the main catalyst react with the halosilane and aluminum compound during the process of ethylene polymerization, e.g., when the main catalyst is added together with halosilane and an aluminum compound, which are cocatalysts, in the process for polymerization

of ethylene. Additionally, in the “Solid Catalyst Preparation” section, in example 1, Menon does not appear to teach or suggest the use of an aluminum-containing cocatalyst and halosilane catalyst. Instead, Menon indicates in the “Polymerization of Ethylene” section of example 1, the addition and use of an aluminum-containing cocatalyst and a halosilane cocatlayst. Applicant submits that the process described in the “Solid Catalyst Preparation” section is comparable to the process described in Applicant’s claims, but does not appear to teach all of the features of Applicant’s claims. The process described in the “Polymerization of Ethylene” section, although describing the use of cocatalyst components, is not related to Applicant’s claimed process. Applicant submits therefore, that the use of a halosilane and an aluminum compound as described in Menon is not related to Applicant’s claimed process.

Applicant’s claimed process forms a catalyst that may be used to obtain a polymer that has both a high melt index and a high bulk density. In contrast, Menon, as described above, does not appear to teach the use of a catalyst production process as described in Applicant’s claims, nor does Menon appear to teach or suggest the formation of high bulk density polymers.

Applicant respectfully requests removal of the rejections of claim 17 and the claims dependent thereon.

**C. The Claims Are Not Anticipated By Klimek Pursuant To 35 U.S.C. § 102(b)**

The Examiner rejected claims 1-7 and 9-32 under 35 U.S.C. 102(b) as anticipated by U.S. Patent No. 5,587,436 to Klimek et al. (hereinafter “Klimek”). Applicant respectfully disagrees with these rejections.

The Examiner states:

Klimek, et al. teach an ethylene catalyst (col. 3, l. 14-16) having a magnesium dihydroxycarbonylide (prepared from reacting Mg with an alcohol) (col. 5, l. 36-44) followed by a titanium compound (col. 5, l. 17-35; col. 6, l. 17-42; col. 6, l. 43 – col. 7, l. 2; Example in col. 10) and/or vanadium compound

(col. 7, l. 45 – col. 8, l. 27) and/or silica compound, particularly a silica halide or hydrocarbyloxide silica (col. 7, l. 3-44; col. 8, l. 31-37) with an organophosphorus complex (col. 5, l. 9 – col. 17; example; col. 14, l. 10 – col. 18, l. 16). Electron donors like triphenylphosphine oxide are cited (col. 5, l. 45-57). Organoaluminum cocatalyst like alkylaluminum halide is cited (col. 5, l. 58 – col. 6, l. 2). Activators and or modifiers are cited like boron halides (col. 6, l. 3-16).

Klimek provides five embodiments of producing a catalyst. Klimek states:

One preferred supported catalyst of the above type useful for the preparation of the propylene-ethylene copolymers in accordance with the invention, referred to as embodiment I, is obtained by: (a) treating silica to remove surface hydroxyl groups... (b) contacting said treated silica with (1) a modifying compound selected from the group consisting of silicon halides, boron halides, aluminum halides, alkyl silicon halides and mixtures thereof; and (2) at least one hydrocarbon soluble magnesium-containing compound... (c) contacting said product of step (b) with at least one titanium-containing compound having the structural formula  $Ti(OR)_nX_m$ , where R is aryl, alkyl or mixtures thereof; X is halogen; n is an integer of 1 to 4; m is 0 or an integer of 1 to 3; and the sum of m and n is 4; and (d) treating the product of step (c) with a titanium-containing compound having the structural formula  $TiX^1_p(OR^1)_q$ , where  $X^1$  is halogen;  $R^1$  is aryl or alkyl; p is an integer 1 to 4; q is 0 or an integer of 1 to 3; and the sum of p and q is 4, with the proviso that the titanium-containing compound of this step is not the same as the titanium-containing compound of step (c).

(Klimek, column 6, lines 43-67)

In another preferred embodiment (embodiment II), the catalyst is obtained by treating silica to remove surface hydroxyl groups... reacting said modified silica support having a selective distribution of reactive hydroxyl groups with a magnesium compound reactive with said surface hydroxyl groups, optionally reacting the thus obtained product with a silicon halide, alkyl silicon halide, boron halide or aluminum halide, further reacting the so-produced first material with a tetra-substituted organo halogen-free titanium compound wherein the organic moiety sterically hinders accessibility of said organo titanium compound to the reactive sites on the modified silica support and thereafter reacting the so-produced second material with a titanium halide.

(Klimek, column 7, lines 3-17)

For yet another preferred embodiment (embodiment III), the catalyst is prepared by (a) contacting silica, in random order, with (1) at least one hydrocarbon soluble magnesium-containing compound; and (2) a first

modifying compound selected from the group consisting of silicon halide; boron halides, aluminum halides and mixtures thereof followed by a second modifying compound selected from the group consisting of a silane of the formula  $\text{SiH}_r\text{X}^2_s$ , where  $\text{X}^2$  is halogen; r is an integer of 1 to 3; and s is an integer of 1 to 3, with the proviso that the sum of r and s is 4, hydrogen halides having the structural formula  $\text{HX}^3$ , where  $\text{X}^3$  is halogen, and mixtures thereof, said sequence of contact of silica with said components (1) and (2) being random; (b) contacting the product of step (a) with a first titanium-containing compound having the structural formula  $\text{Ti}(\text{OR})_m\text{X}_n$ , where R is hydrocarbyl or cresyl; X is halogen; m is an integer of 1 to 4; and n is 0 or an integer of 1 to 3, with the proviso that the sum of m and n is 4; and (c) contacting the product of step (b) with a second titanium-containing compound having the structural formula  $\text{TiX}^1_p(\text{OR}^1)_q$ , where  $\text{X}^1$  is halogen;  $\text{R}^1$  is hydrocarbyl; p is an integer of 1 to 4; q is 0 or an integer of 1 to 3, with the provisos that the sum of p and q is 4 and that said first titanium-containing compound and said second titanium-containing compound are different.

(Klimek, column 7, lines 19-43)

For another preferred embodiment (embodiment IV), a highly useful catalyst is produced by (a) treating an inert inorganic support with hexamethyl disilazane to remove surface hydroxyl group...; (b) contacting said treated inert inorganic support with a hydrocarbon soluble magnesium compound; (c) contacting said product of said step (b) with a modifying compound selected from the group consisting of silicon halides, boron halides, aluminum halides, hexaalkyl disilazanes and mixtures thereof; (d) contacting said product of said step (c) with a vanadium compound having the structural formula  $\text{V}(\text{O})_2\text{X}^1_{4-s}$ , where  $\text{X}^1$  is halogen; and s is 0 or 1; a first titanium-containing compound having the structural formula  $\text{TiX}^3_p(\text{OR}^3)_q$  where  $\text{X}^3$  is halogen;  $\text{R}^3$  is hydrocarbyl; p is an integer of 1 to 4; and q is 0 or an integer of 1 to 3, with the proviso that the sum of p and q are 4 and, optionally a second titanium-containing compound of the formula  $\text{Ti}(\text{OR}^2)_n\text{X}_m$ , where  $\text{R}^2$  is hydrocarbyl;  $\text{X}^2$  is halogen; n is an integer of 1 to 4; and m is 0 or an integer of 1 to 3 with the proviso that the sum of n and m is 4; and with the further proviso that if two titanium-containing compounds are used said first and said second titanium-containing compounds are not identical.

(Klimek, column 7, lines 45-67)

A final preferred embodiment (embodiment V) utilizes a catalyst component obtained by (a) heating an inert inorganic support...(b)contacting the treated inert inorganic compound with a hydrocarbon soluble magnesium compound; (c) contacting the product of said step (b) with a modifying compound selected from the group consisting of silicon halides, boron halides, aluminum halides, alkyl silicon halides, hexaalkyl disilazanes and mixtures

thereof; and (d) contacting the product of said step (c) with a vanadium compound having the structural formula  $V(O_2)X^{1_{4-s}}$ , is halogen and s is 0 or 1; a first titanium-containing compound having the structural formula  $TiX^3_p(OR^3)_q$ , where  $X^3$  is halogen,  $R^3$  is hydrocarbyl, p is an integer of 1 to 4, and q is 0 or an integer of 1 to 3, with the proviso that the sum of p and q are 4 and, optionally, a second titanium-containing compound of the formula  $Ti(OR^2)_nX^2_m$ , where  $R^2$  is hydrocarbyl,  $X^2$  is halogen, n is an integer of 1 to 4, and m is 0 or an integer of 1 to 3 with the proviso that the sum of n and m is 4; and with the further proviso that if two titanium-containing compounds are used said first and said second titanium-containing compounds are not identical.

(Klimek, column 8, lines 3-25)

Klimek does not appear to teach or suggest the features of claim 17 including, but not limited to: "reacting the magnesium solution with an ester compound comprising at least one hydroxy group, or a phosphorus compound and a silicon compound comprising alkoxy groups". Klimek does not appear to teach or suggest the features of claim 17 including, but not limited to: "then producing a solid component by adding a mixture of a titanium compound and a silicon compound thereto". Klimek does not appear to teach or suggest the features of claim 17 including, but not limited to: "reacting the solid component with an aluminum compound, and then reacting the same with a titanium compound, or a titanium compound and a vanadium compound." Applicant respectfully requests removal of the rejections of claim 17 and the claims dependent thereon.

Furthermore, Klimek appears to list a limited number of electron donors that may be used in the production of a titanium catalyst, but does not appear to describe which of the listed electron donors should be used to produce a catalyst having high catalytic activity and providing a polymer of high melt index and bulk density. Furthermore, in the section of Klimek entitled "Preparation of Titanium Catalyst Component", there does not appear to be any use of any ester compound having at least one hydroxyl group or a phosphorous compound and a silicon compound having alkoxy groups. Applicant submits, therefore, the Klimek does not appear to teach or suggest the feature using an ester compound having at least one hydroxy group or a phosphorous compound and a silicon compound having alkoxy groups.

In Klimek, the electron donor included in the catalyst composition appears to be a halogen from a silicon halide, a halogen from a boron halide, or a halogen from an aluminum halide.

In the electron donor used in Applicant's claims, oxygen donates electrons in the ester compound including at least one hydroxy group. The oxygen of the hydroxyl group is the primary electron donor and is bonded to carbon and hydrogen. For the phosphorous compound, phosphorous is the electron donating element. The oxygen atoms bonded to phosphorous in, for example, the phosphoric acid group are the primary electron donor. For the silicon compound,

oxygen is the primary electron donor. The oxygen in the silicon compound is part of an alkoxy group and is bonded to carbon. Applicant submits that the electron donors of Klimek are not the same as the electron donors described in Applicant's claims.

The Examiner has drawn attention to Klimek's use of a hydrocarbylalkoxysilane, however, Applicant disagrees with the relevance of this reagent. The hydrocarbylalkoxysilane appears to be used as a cocatalyst that is used, independently of a titanium solid catalyst, during polymerization.

Applicant's claims are directed to a multi-step process that includes the following reactions:

preparing a magnesium solution by contact-reacting a halogenated magnesium compound with alcohol;

reacting the magnesium solution with an ester compound comprising at least one hydroxy group, or a phosphorus compound and a silicon compound comprising alkoxy groups, and then producing a solid component by adding a mixture of a titanium compound and a silicon compound thereto; and

reacting the solid component with an aluminum compound, and then reacting the same with a titanium compound, or a titanium compound and a vanadium compound.

In Klimek's preferred embodiments, no such processing steps appear to be described.

Additionally, in the process described in Applicant's claims, the reaction system is in solution phase, i.e. a single homogeneous liquid phase, at the time of introducing an electron donor. In Klimek, however, the reaction system is in a heterogeneous mixed phase of solid and liquid at the time of introducing an electron donor, since the electron donor is introduced after solid precipitation is formed. The three dimensional structure of the resulting catalyst may be different for at least the same reasons present before with regard to Menon.

Applicant respectfully requests removal of the rejections of claim 17 and the claims dependent thereon.

D. **Claim 8 is Not Unpatentable Over Klimek In View of Yang Pursuant To 35 U.S.C. § 103(a)**

The Examiner rejected 8 under 35 U.S.C. 103(a) as unpatentable over Klimek in view of U.S. Patent No. 6,034,025 to Yang et al. Applicant respectfully disagrees with this rejection. To expedite the case, however, claim 8 has been cancelled.

E. **Additional Remarks**

Applicant submits that all claims are in condition for allowance. Favorable reconsideration is respectfully requested.

Applicant respectfully requests a one-month extension of time to respond to the Office Action dated October 21, 2004. A fee authorization form in the amount of \$110.00 is enclosed for the extension of time fee. If any further extension of time is required, Applicant hereby requests the appropriate extension of time. If any fees are inadvertently omitted or if any additional fees are required or have been overpaid, please appropriately charge or credit those fees to Meyertons, Hood, Kivlin, Kowert & Goetzel, P.C. Deposit Account Number 50-1505/5333-01300/EBM.

Respectfully submitted,



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